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Case Number: T 2111/15 - 3.4.03

Application Number: 11000919.8

Publication Number: 2387027

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Language of the proceedings: EN

Title of invention:
Display apparatus

Applicant:
Samsung Display Co., Ltd.

Headword:

Relevant legal provisions:
EPC Art. 83

Keyword:
Sufficiency of disclosure - (no)

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Catchword:

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Boards of Appeal

Chambres de recours

Boards of Appeal of the
European Patent Office
Richard-Reitzner-Allee 8
85540 Haar
GERMANY
Tel. +49 (0)89 2399-0
Fax +49 (0)89 2399-4465

Case Number: T 2111/15 - 3.4.03

D E C I S I O N
of Technical Board of Appeal 3.4.03
of 5 February 2020

Appellant: (Applicant)	Samsung Display Co., Ltd. 17113, 1, Samsung-ro Giheung-Gu Yongin-si Gyeonggi-do (KR)
Representative:	Dr. Weitzel & Partner Patent- und Rechtsanwälte mbB Friedenstrasse 10 89522 Heidenheim (DE)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted on 11 June 2015 refusing European patent application No. 11000919.8 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman	G. Eliasson
Members:	M. Stenger
	W. Van der Eijk

Summary of Facts and Submissions

I. The appeal concerns the decision of the Examining Division to refuse European patent application no. 11000919 because it did not fulfill the requirements of Articles 83, 84 and 123(2) EPC.

II. With the grounds of appeal, the appellant requested that the decision be set aside and that a patent be granted according to a main request or to one of auxiliary requests 1 to 7. All requests were filed with the grounds of appeal.

III. In the Board's preliminary opinion preparing the oral proceedings, objections with respect to Article 83 EPC were raised.

IV. The appellant did not submit any arguments concerning the preliminary opinion of the Board. Instead, it notified the Board that it would not be attending the oral proceedings.

V. Claim 1 of the main request has the following wording (labeling a), b), ... added by the Board):

A display apparatus comprising:
a) *a display panel (110) comprising a plurality of pixels, the display panel (110) being divided into a plurality of space areas (A1-A12) and a plurality of boundary areas (B1-B23) between the space areas (A1-A12) by a plurality of parameters along a first x-axis*

and a plurality of parameters along a y-axis set in accordance with the number of the space areas (A1-A12);

b) *a data compensating part (320, 320A, 320B) including a compensation control part (321, 323, 325), an look-up tables storing part (328) and a data storing part (329);*

c) *the look-up tables storing part (328) storing a plurality of look-up tables (LUT1, , LUTm, LUTm+1, ..., LUTk) mapped to the plurality of space areas (A1-A12) in accordance with each of a plurality of set temperature values (Tl,.., Tm, Tm+1,.., Tk);*

d) *the compensation control part (321, 323, 325) receiving a temperature value (t(n)) of the display panel (110) measured from a temperature sensor (410) of the display apparatus or measuring a temperature value (t(n)) of the display panel (110) internally,*

e) *the compensation control part (321, 323, 325) further receiving an image data (d(n)) and a position data (p(x0,y0)) of the image data (d(n)),*

f) *the compensation control part (321, 323, 325) further determining a set temperature value (T(n)) corresponding to the temperature value (t(n)), reading a plurality of look-up tables (LUT1,..,LUTm, LUTm+1,, LUTk) mapped to the plurality of space areas (Al-A12) of the display panel (110) based on the determined set temperature value (T(n)) from the look-up tables storing part (328) and generating a compensation data (D(n)) of the image data (d(n)) positioned at the space areas (Al-A12) using the look-up tables corresponding to the determined set temperature value (T(n));*

g) *a timing control part (310) for receiving the image data (d(n)), wherein the timing control part (310) provides the data compensating part (320, 320A, 320B) with the position data (p(x0,y0)) of the image data (d(n));*

h) *the data storing part (329) for storing a generated compensation data (D(n)), wherein the compensation control part (321, 323, 325) receives the compensation data (D(n-1)) of a previous (n-1)-th frame when generating the compensation data (D(n)) of a nth frame;*

i) *a data driving part (140) converting the compensation data (D(n)) into an analog data voltage and providing the display panel (110) with the analog data voltage.*

VI. The wording of claim 1 of auxiliary request 1 differs from the wording of claim 1 of the main request in that feature f) is replaced by feature f') as follows:

f') *the compensation control part (321, 323, 325) further determining a set temperature value (T(n)) equal to the measured temperature value (t(n)) or by selecting one of the set temperature values (T(n)), which is smaller than and closest to the measured temperature value (t(n)) or which is greater than and closest to the measured temperature value (t(n)) or by using an interpolation method, reading a plurality of look-up tables (LUT1,..,LUTm, LUTm+1,.., LUTk) mapped to the plurality of space areas (A1-A12) of the display panel (110) based on the determined set temperature value (T(n)) from the look-up tables storing part (328) and generating a compensation data (D(n)) of the image*

data (d(n)) positioned at the space areas (A1-A12) using the look-up tables corresponding to the determined set temperature value (T(n));

VII. The wording of claim 1 of auxiliary request 2 differs from claim 1 of auxiliary request 1 in that it comprises, after feature c), feature c') and that feature d) is replaced by feature d') as follows:

c') *a temperature sensor (410) for measuring a temperature value (t(n));*

d') *the compensation control part (321, 323, 325) receiving the temperature value (t(n)) from the temperature sensor (410),*

VIII. The wording of claim 1 of auxiliary request 3 differs from the wording of claim 1 of auxiliary request 2 in that feature a) is replaced by feature a') as follows:

a') *a display panel (110) comprising a plurality of pixels, one side of the display panel (110) extending along an x-axis and another side of the display panel (110) extending along an y-axis, the display panel (110) being divided into a plurality of rectangular space areas (A1-A12) and a plurality of rectangular boundary areas (B1-B23) between the space areas (A1-A12) by a plurality of parameters along the x-axis and a plurality of parameters along the y-axis set in accordance with the number of the space areas (A1-A12), wherein the corner points of the rectangular space areas (A1-A12) and of the rectangular boundary areas (B1-B23) are defined by the parameters along the x-axis and y-axis, respectively;*

IX. The wording of claim 1 of auxiliary request 4 differs from the wording of claim 1 of auxiliary request 3 in that feature e) is replaced by feature e') as follows:

e') *the compensation control part (321, 323, 325) further receiving an image data (d(n)), which is a gray-scaled value of an n-th frame, and a position data (p(x0,y0)) of the image data (d(n)), which is a position coordinate of a pixel corresponding to the image data (d(n)) positioned on the display panel (110),*

X. The wording of claim 1 of auxiliary request 5 differs from the wording of claim 1 of auxiliary request 4 in that feature f') is replaced by feature f'') as follows:

f'') *the compensation control part (321, 323, 325) further determines whether a set temperature value (T(n)) corresponding to the measured temperature value (t(n)) exists or not and if the set temperature value (T(n)) exists reads a plurality of look-up tables (LUTI,..,LUTm, LUTm+1,.., LUTk) mapped to the plurality of space areas (A1-A12) of the display panel (110) based on the determined set temperature value (T(n)) from the look-up tables storing part (328) and generates a compensation data (D(n)) of the image data (d(n)) positioned at the space areas (A1-A12) using the look-up tables corresponding to the determined set temperature value (T(n)), and if a set temperature value (T(n)) does not exist and the measured temperature value (t(n)) is between an m-th set temperature value (Tm) and an (m+1)-th set temperature*

value (Tm+1) generates a compensation data (D(n)) of the image data (d(n)) positioned at the space areas (Al-A12) using a compensation data (D(n-1)) of an (n-1)-th frame stored in the data storing part (329), a compensation data generated through an m-th look-up table (LUTm) mapped corresponding to an m-th set temperature value (Tm), and a compensation data generated through an (m+l)-th look-up table (LUTm+1) mapped corresponding to an (m+1)-th set temperature value (Tm+1);

XI. The wording of claim 1 of auxiliary request 6 differs from the wording of claim 1 of auxiliary request 5 in that it comprises, after feature h) additional feature h') and at its end the additional feature j) as follows:

h') *the compensation control part (321, 323, 325)generates a compensation data (D(n)) of an image data (d(n)) positioned at the boundary area (B1- B23) using a compensation data (D(n)) of an image data (d(n)) respectively positioned at each of two space areas (A1-A12) of the plurality of space areas(A1-A12), when the boundary area (B1-B23) is positioned between the two space areas (A1-A12) adjacent to each other,*

j) *the compensation control part (321, 323, 325) further generates a compensation data (D(n)) of an image data (d(n)) positioned at the boundary area (B1-B23) using a compensation data (D(n)) of an image data (d(n)) respectively positioned at each of four space areas (A1-A12) of the plurality of space areas (A1-A12), when the boundary area (B1-B23) is positioned between the four space areas (A1-A12) adjacent to each other.*

XII. The wording of claim 1 of auxiliary request 7 differs from the wording of claim 1 of auxiliary request 6 in that features h') and j) are replaced, respectively, by features h'') and j') as follows:

h'') *the compensation control part (321, 323, 325) generates a compensation data (D(n)) of an image data (d(n)) positioned at the boundary area (B1- B23) using a compensation data (D(n)) of an image data (d(n)) respectively positioned at each of two space areas (A1-A12) of the plurality of space areas(A1-A12) using a linear interpolation method, when the boundary area (B1-B23) is positioned between the two space areas (A1-A12) adjacent to each other,*

j') *the compensation control part (321, 323, 325)further generates a compensation data (D(n)) of an image data (d(n)) positioned at the boundary area (B1-B23) using a compensation data (D(n)) of an image data (d(n)) respectively positioned at each of four space areas (A1-A12) of the plurality of space areas (A1-A12) using a linear interpolation method, when the boundary area (B1-B23) is positioned between the four space areas (A1-A12) adjacent to each other.*

Reasons for the Decision

1. The appeal is admissible.

2. The application

The application concerns a display panel comprising a plurality of pixels. The time necessary for switching

the pixels of such a display panel from one state to another depends on the characteristics of the materials involved which are temperature dependent. The temperature of a display panel normally is not uniform. Instead, its temperature will vary over its surface depending on the arrangement of the electronic circuits used to drive the pixels. Further, it will vary with time.
The application aims at reducing the impact of these variations by virtually dividing the panel surface into space areas (A1 to A12) and using look-up tables comprising temperature compensation data values D(n) mapped to the space areas for determining the analog voltages used for driving the pixels.

3. Article 83 EPC

According to feature i) present in the independent claims of all requests, the compensation data (D(n)) are converted into an analog data voltage which is then provided to the display panel.
Consequently, the data that are displayed by the display panel are the compensation data (D(n)), as also submitted by the appellant (see the paragraph bridging pages 6 and 7 of the grounds of appeal).

According to each of features f), f') and f''), one of them being present in each of the independent claims of all requests, the compensation data (D(n)) are generated *of the image data (d(n))*.
However, it is not apparent from the application as a whole how the current image data (d(n)) are actually used when generating the current compensation data (D(n)) (see section 1.2.1 of the contested decision, in particular the two middle paragraphs of page 12),

contrary to the allegation of the appellant made in the paragraph bridging pages 6 and 7 of the grounds of appeal.

In particular, the generation of (D(n)) as described in [46] to [53] of the published application and defined in

- claim 3 of the main request,
- claim 3 of the first to fourth auxiliary request, and
- claims 1 and 2 of the fifth to seventh auxiliary request

does not take into account the current image data (d(n)) at all. Instead, compensation data of previous frames (D(n-1)) are used to generate current compensation data (D(n)), with or without an interpolation step.

In a similar manner, compensation data of neighbouring areas $D_{A1}(n)$, $D_{A2}(n)$,... are used in equations 4 to 10 in [88] to [102] of the published application in interpolation steps, while the current image data (d(n)) are not taken into account for generating the current compensation data (D(n)) according to these equations, either.

Referring to the figure on page 9 of the grounds of appeal, the appellant submitted that the current compensation data (D(n)) were determined from *present image data (d(n))* and *compensated previous image data (d(n-1))* (grounds of appeal, page 8, penultimate paragraph).
However, the look-up table depicted in that figure is not contained in the application. On the contrary, no particular look-up table is defined in the application at all.

The Board acknowledges that the use of look-up tables similar to the one depicted on page 9 of the grounds of appeal would make sense in LCD panels using one-frame buffer overdrive techniques or dynamic capacitance compensation techniques (DCC technology, as mentioned in [3] of the published application).
None of the claims of any of the requests, however, is directed at an LCD panel using such techniques, whereby the look-up tables mentioned in the claims do not necessarily have to be interpreted as being similar to the one depicted on page 9 of the grounds of appeal.

Further, the look-up table presented by the appellant in the grounds of appeal does not relate to the *compensation data of a previous (n-1)-th frame* (for which the variable (D(n-1)) should be used according to the application) or *compensated previous image data* as submitted by the appellant (grounds of appeal, page 8, antepenultimate and penultimate paragraphs).
Instead, this table relates to *d(n-1)* (column index in the uppermost row of the table) which, according to the application, should correspond to the *image data* of a previous frame n-1.
The Board notes that the use of the variable (d(n-1)) in the penultimate paragraph of page 8 of the grounds of appeal in relation to *compensated* previous image data is not consistent with the terminology of the application, according to which the variable *d* denotes image data while the variable *D* refers to compensation data.

In addition, look-up tables like the one presented by the appellant *require* the use of current image data (d(n)) (row index in the left-hand column) in order to

be able to look up the corresponding current compensation data (D(n)) in the table.
Thus, even if the look-up tables claimed were considered to be look-up tables similar to the one shown on page 9 of the grounds of appeal, it would not be apparent how they could be used in the steps described in [46] to [53] and in equations 4 to 10 of the published application which do not refer to the image data (d(n)) as set out above.

All the independent claims of all requests on file are directed at a *display apparatus* which displays *compensation data (D(n)) generated of image data (d(n))* according to features f), f'), f'') and i).
However, the application as a whole does not disclose the generation of compensation data (D(n)) taking into account the current image data (d(n)).

Consequently, the requirements of Article 83 EPC are not met by any of the requests on file.

The Board thus comes to the same conclusion as the Examining Division (contested decision, point 1.2.1).

4. None of the requests on file fulfills the requirements of the EPC. Thus, the appeal must fail.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

S. Sánchez Chiquero G. Eliasson

Decision electronically authenticated